Two photon near-field fluorescence imaging of nanostructures with a metal tip

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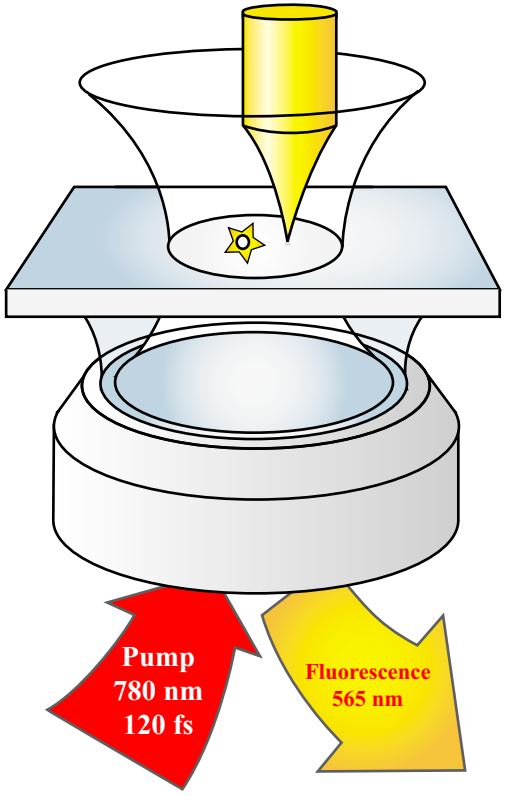
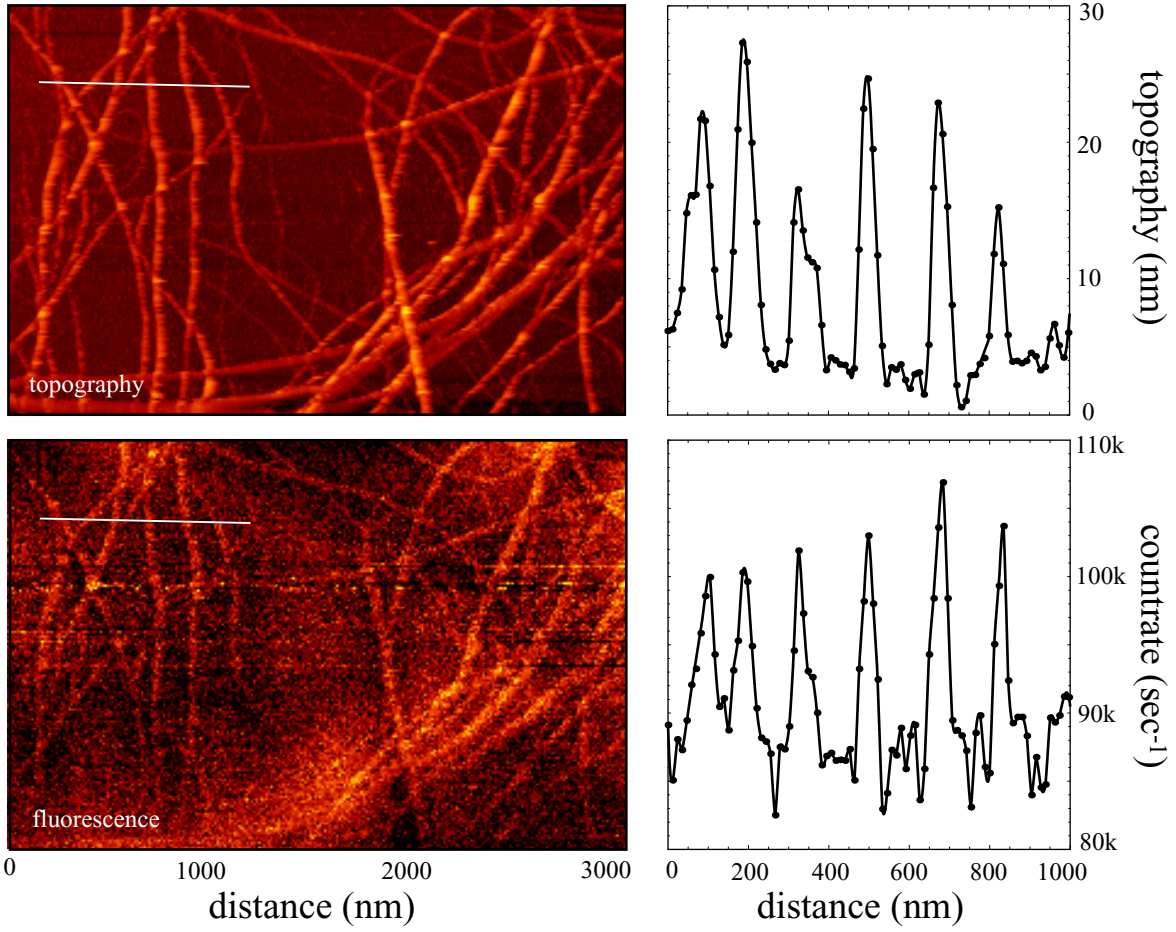
Our near-field optical microscope uses a sharp gold tip to highly localize a 780 nm pump pulse. This nansource of light provides two red photons, which together excite the sample to emit a single yellow photon. The sample is scanned beneath the tip, and a fluorescence image is recorded.





In this manner, optical images can be recorded of nanostrucutres whose spatial resolution is **not limited by diffraction**, but only by the sharpness of the metal tip. Above is a topographical image and a near-field fluorescence image of PIC J-Aggregates. The full-width at half maximum of the features shown in the line-scans is **25 nm**. This compares with a far-field resolution of 350 nm.

Nano-Optics Research for Undergraduate Students

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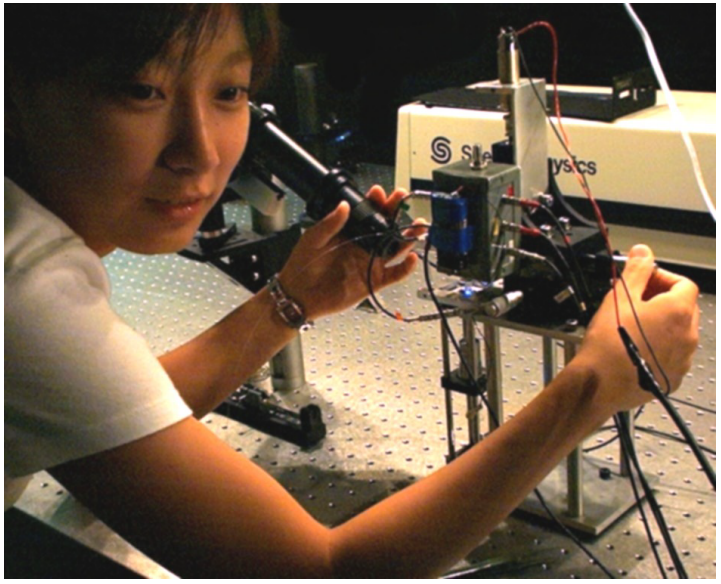

Educational work in optics is a wonderful opportunity to naturally connect research in basic physics to its implementation as an emerging technology. By incorporating fields as diverse as quantum optics, electrical engineering, and molecular biology, undergraduate research fellowships in optics provide excellent introductions to the breadth of possible careers for future scientists.

To the left, Rochester undergraduate Molly Park adjusts the near-field microscope she helped Dr. Alexandre Bouhelier build during her REU fellowship in the Nano-Optics group.

Optical studies of protein dynamics and interactions with cell membranes is an exciting application of nano-optics.

Working with Dr. Andreas Lieb, Rochester undergraduate Nicole Putnam (shown far right) helped to prepare red blood cell ghosts (shown near right) labelled with the dye diTBA, which is specifically linked to the anion exchange membrane protein band3, also called AE1.